JC20 Rec'd PCT/PTO 30 JUL 2001

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 USC 371

ATTORNEY DOCKET NO.: 440490/PALL

U.S. APPLICATION NO.: 09/890355

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/US00/02701	January 31, 2000	January 29, 1999

TITLE OF INVENTION: SEPARATION DEVICAES AND PROCESSES

APPLICANT(S) FOR DO/EO/US: PALL CORPORATION

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 USC 371.

2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 USC 371.

3. ☒ This is an express request to begin national examination procedures (35 USC 371(f)).

4. ☐ The US has been elected by the expiration of 19 months from the priority date (PCT Article 31).

5. ☒ A copy of the International Application as filed (35 USC 371(c)(2))
   a. ☐ is attached hereto (required only if not communicated by the International Bureau).
   b. ☒ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).

6. ☐ An English language translation of the International Application as filed (35 USC 371(c)(2)).

7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 USC 371(c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.

8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 USC 371(c)(3)).

9. ☐ An oath or declaration of the inventor(s) (35 USC 371(c)(4)).

10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 USC 371(c)(5)).

11. Nucleotide and/or Amino Acid Sequence Submission
   a. ☐ Computer Readable Form (CRF)
   b. Specification Sequence Listing on:
      i. ☐ CD-ROM or CD-R (2 copies); or
      ii. ☐ Paper Copy
   c. ☐ Statement verifying identity of above copies

Items 12 to 19 below concern other document(s) or information included:

12. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
   ☐ Form PTO-1449
   ☐ Copies of Listed Documents

13. ☐ An assignment for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.

14. ☐ A FIRST preliminary amendment.
   ☐ A SECOND or SUBSEQUENT preliminary amendment.

15. ☐ A substitute specification.

16. ☐ A change of power of attorney and/or address letter.

17. ☒ Application Data Sheet Under 37 CFR 1.76

18. ☒ Return Receipt Postcard

19. ☒ Other items or information: Copy of application as filed and corrected drawings; International Search Report (Forms PCT/ISA/220 and PCT/ISA/210); and International Preliminary Examination Report (Forms PCT/IPEA/416 and PCT/IPEA/409)

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U.S. APPLICATION NO.	INTERNATIONAL APPLICATION NO.	ATTORNEY DOCKET NO.
09/890355	PCT/US00/02701	440490/PALL

20. ☒ The following fees are submitted:	CALCULATIONS	PTO USE ONLY
Basic National Fee (37 CFR 1.492(a)(1)-(5)):		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO $1,000.00		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO ..... $ 860.00		
International preliminary examination fee (37 CFR 1.482) paid to USPTO, but international search fee (37 CFR 1.445(a)(2))paid to USPTO ..... $ 710.00		
International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4)..... $ 690.00		
International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1) to (4) ..... $ 100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT=	$690.00	
Surcharge of $130.00 for furnishing the National fee or oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date	$	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total Claims	7 -20=		x $ 18.00	$	
Independent Claims	7 - 3 =	4	x $ 80.00	$320.00	
☐ Multiple Dependent Claim(s) (if applicable)			+$270.00	$	

TOTAL OF ABOVE CALCULATIONS=	$1010.00	
☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.	$	
SUBTOTAL=	$	
Processing fee of **$130.00** for furnishing English Translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date.	$	
TOTAL NATIONAL FEE=	$1010.00	
Fee for recording the enclosed assignment. The assignment must be accompanied by an appropriate cover sheet. **$40.00** per property +	$	
TOTAL FEE ENCLOSED=	$1010.00	
	Amount to be: refunded	$
	charged:	$

a. ☒ A check in the amount of $1010.00 to cover the above fee is enclosed.

b. ☐ Please charge Deposit Account No. 12-1216 in the amount of $ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 12-1216. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

23548
PATENT TRADEMARK OFFICE

John M. Belz, Registration No. 30,359
One of the Attorneys for Applicant(s)

30 July 2001
Date

In re Appln. of FENDYA, ET AL.
Attorney Docket No. 440490

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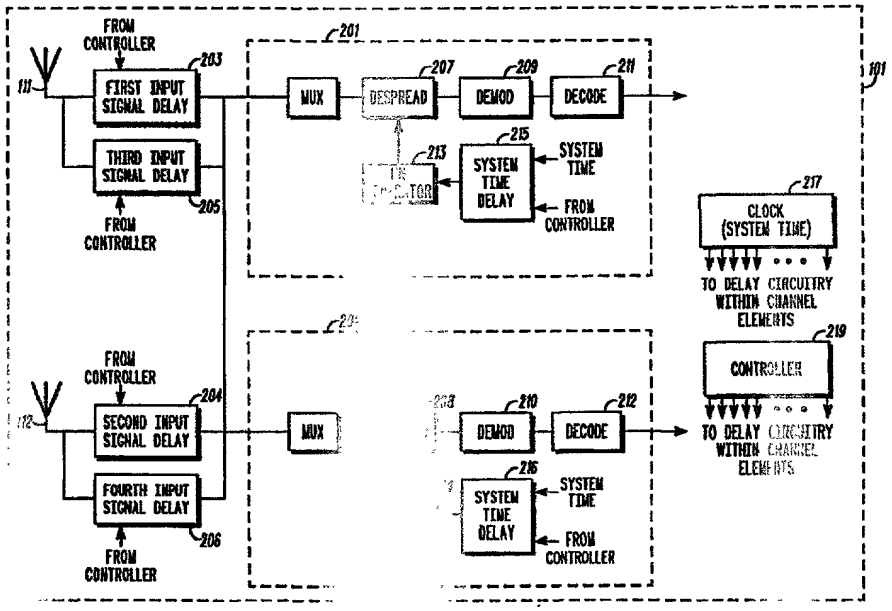

(57) Abstract

Receive: ...2) within a base station (101) ... smission from a remote unit (114). ... received signal is delayed a first amount b... ... circuitry (203), and a second ... ond delay circuitry (204). During ... ading, a delayed input signal is despread wi... ...e–Random (PN) code. The sys... ...ed by the PN generators (213, 214) ... delayed a third time period by third and for... ...ircuitry (215, 216).

RANGE EXTENSION WITHIN A COMMUNICATION SYSTEM

Field of the Invention

The present invention relates generally to communication systems and, in particular, to extending the range of a base site in a cellular communication system.

Background of the Invention

In current Code Division, Multiple Access (CDMA) communication systems, receivers (channel elements) restrict a search and demodulation window to 512 chips. More particularly, a remote unit accessing a CDMA communication system can have a round-trip delay of no more than 416 micro seconds (512 chips), or equivalently, a maximum distance of 62 kilometers (km) from the base station. Remote units with a larger delay than 512 chips will not be within a base station's search window, and will not be acquired by the base station.

Although the above restriction on round-trip delay is adequate for most urban areas, there exists locations where a maximum cell size of greater than 62 km is desired. For example, along coastal areas, or within very sparsely populated locations, it may be economically unfeasible to have small cell sizes. Therefore a need exists for a base station that has an extended cell size. Additionally, it would be beneficial if existing CDMA equipment can be inexpensively modified to provide such coverage.

Brief Description of the Drawings

FIG. 1 is a block diagram of a communication system in accordance with the preferred embodiment of the present invention.

FIG. 2 is a block diagram of the base site of FIG. 1 in accordance with the preferred embodiment of the present invention.

FIG. 3 is a flow chart showing operation of the base station of FIG. 1 in accordance with the preferred embodiment of the present invention.

Detailed Description of the Drawings

To address the need for a base station having an extended cell size, a method and apparatus for extending the cell size of a base station is provided. Receivers within a base station receive a transmission from a remote unit. The received signal is delayed a first amount by first delay circuitry, and a second amount by second delay circuitry. During despreading, a delayed input signal is despread with a Pseudo-Random (PN) code. The system time utilized by the PN generators is delayed a third time period by third and fourth delaying circuitry. As a result of delaying system time, the PN sequence utilized to despread the delayed signals will not repeat on the even second of system time, but will begin repeating a time period after every even second of system time. By delaying the signal input into a receiver, as well as delaying system time utilized by the PN generator, allows base stations to receiving transmissions from remote units outside the normal 512 chip window. Additionally, existing base stations can be inexpensively modified in accordance with the preferred embodiment by the addition of delay circuitry as described above.

The present invention encompasses an apparatus for range extension within a communication system. The apparatus comprises a first receiver comprising a first input signal delaying a received signal as an input and outputting the received signal delayed a first time period. The receiver additionally comprises a first despreader receiving the received signal delayed the first time period as an input and outputting a first despread signal, wherein the first despreader utilizes a spreading code delayed a second time period with respect to system time.

The present invention additionally encompasses a method for range extension within a communication system. The method comprises the steps of receiving a first signal and delaying the first signal a first time period to produce a first delayed signal. The delayed signal is despread utilizing a spreading code that has been delayed a second time period in order to receive signals transmitted

within a first range. The method additionally comprises the steps of receiving a second signal and delaying the second signal a third time period to produce a second delayed signal. The second delayed signal is despread utilizing the spreading code that has been delayed the second time period in order to receive signals transmitted within a second range.

The present invention additionally encompasses a method for range extension within a Code Division, Multiple Access (CDMA) communication system. The method comprises the steps of receiving a first signal transmitted from a remote unit and delaying the first signal a first time period to produce a first delayed signal. In this embodiment of the invention the first time period is equal to a time period selected from the group consisting of 0, N, 2N, . . . , (K-1)N, where N is a maximum search and demodulation range of the second receiver and K is the maximum round-trip delay divided by N, rounded up to a nearest integer. The first delayed signal is despread utilizing a Pseudo-Random (PN) code that has been delayed a second time period in order to receive signals transmitted within a first range. The method also comprises the steps of receiving a second signal transmitted from the remote unit and delaying the second signal a third time period to produce a second delayed signal. In this embodiment of the present invention the third time period is equal to a time period selected from the group consisting of 0, N, 2N, . . . , (K-1)N. Finally, the second delayed signal is despread utilizing the PN code that has been delayed the second time period in order to receive signals transmitted within a second range.

Turning now to the drawings, where like numerals designate like components, FIG. 1 is a block diagram of communication system 100 in accordance with the preferred embodiment of the present invention. In the preferred embodiment of the present invention, communication system 100 utilizes a CDMA system protocol as described in Cellular System Remote unit-Base Station Compatibility Standard of the Electronic Industry Association/Telecommunications Industry Association Interim Standard 95-B (TIA/EIA/IS-95B), which is incorporated by reference herein. (TIA/TIA can be contacted at 2001 Pennsylvania Ave. NW Washington DC 20006). In alternate embodiments communication system 100 may utilize other analog or digital cellular communication system protocols such as, but not limited to, the Narrow band Advanced Mobile Phone Service (NAMPS) protocol, the Advanced Mobile

Phone Service (AMPS) protocol, the Global System for Mobile Communications (GSM) protocol, the Personal Digital Cellular (PDC) protocol, or the United States Digital Cellular (USDC) protocol. Communication system 100 includes sectorized cell 115, and base station 101 which is suitably coupled to antennas 108-113. Although not shown, one of ordinary skill in the art will recognize that base station 101 is additionally coupled to necessary infrastructure equipment such as Centralized Base Station Controllers (CBSCs), Mobile Switching Centers (MSCs), and the like.

In the preferred embodiment of the present invention maximum cell range is increased by increasing the range for specified sectors 102-107 only. Thus, in the preferred embodiment of the present invention each sector 102-107 of cell site 115 has a maximum and minimum operational range. A first sector (e.g., sector 104) may receive remote units within a first region (e.g., 0-62 km from base station 101), while an adjacent sector (e.g., sector 105) will receive only remote units within a second region (between 62 km and 124 km from base station 101). Additionally, as will be described below, the maximum cell radius of cell 115 is increased without requiring a redesign of the existing infrastructure equipment's receivers.

FIG. 2 is a block diagram of base station 101 in accordance with the preferred embodiment of the present invention. As shown base station 101 comprises first receiver 201 and second receiver 202. Although only two receivers are shown, one of ordinary skill in the art will recognize that typical base stations comprise many receivers. For example, the Motorola J-CDMA Base Station (SC4840) contains twelve channel cards with 24 receivers residing on each card, resulting in a total of 288 receivers. FIG. 2 additionally shows receivers 201 and 202 having a single antenna port with antennas 111 and 112 as inputs, however, one of ordinary skill in the art will recognize that two antennas may be input into receivers 201 and 202 in order to gain diversity benefits. In the preferred embodiment of the present invention receiver 201 and receiver 202 have input antennas (111 and 112, respectively) originating from sectors (104 and 105, respectively).

As shown, base station 101 comprises input signal circuitry 203-206, and each receiver comprises system time delay circuitry despreading circuitry 207, 208, demodulating circuitry 209, 210, decoding circuitry 211, 212,

and PN generators 213, 214. Base station 101 additionally comprises clock 217 to provide system time, and controller 219. In the preferred embodiment of the present invention delay circuitry 203-206 is a standard digital delay line, and delay circuitry 215-216 is a counter which produces a delayed version of the original system reference pulse. Both of these delay circuits serve to delay signals input into the circuitry for a finite period of time.

Prior to describing operation of base station 101, the following text and equations are provided to show derivation of the time delays utilized by delay circuitry 203-206 and 215-216.

Assume that N is the maximum search and demodulation range of a receiver, and K is the number of search windows that are necessary for covering the desired range. K is equal to the maximum round-trip delay divided by N, rounded up to the nearest integer (i.e., K=Round_up((maxRTD/N)). For example, if a maximum search and demodulation range of a receiver is 512 chips (62 km), and it is desired that base station 101 be able to receive calls having delays of 826 chips (100 km), then N=512 and K=2 (Round_up(826/512)). In the preferred embodiment of the present invention system time delay circuitry 215 and 216 delay system reference time by a time period equal to (K-1)N.

In the preferred embodiment of the present invention signals input into receivers 201-202 are delayed for a period of time prior to being despread. The period of time that a particular signal is delayed is dependent upon a particular range that the receiver wishes to cover. In the preferred embodiment of the present invention these delays are integer multiples of N, up to (K-1)N (i.e., 0, N, 2N, . . ., (K-1)N). Using the above example, with N=512 and K=2, there exist two distinct input signal delays utilized by base 101 (0 and 512 chips). Therefore, when K=2, system time is delayed by N, receivers having no delay perceive a signal transmitted with an 826 chip offset as being transmitted with a 326 chip offset. In other words, actual PN offsets of (K-1)N to KN appear to be offset only 0 to N from the non-delayed baseband.

It should be noted that receivers having PN offsets of jN receive remote units having PN offsets of (NK-N-jN) to (NK-jN). Therefore, any remote unit with a range between (NK-N-jN) and (NK-jN) will be received by the receiver delayed by jN and will not be received by receivers having different input signal

delays since the signal will lie outside of the receiver's search window. This is illustrated in Table 1 for N=512, K=3, and system time delayed 1024 chips.

Input signal delay	Perceived offset for remote unit transmitting between 0-62 km (0-511 chip offset)	Perceived offset for remote unit transmitting between 63-124 km (512-1023 chip offset)	Perceived offset for remote unit transmitting between 125-186 km (1024-1535 chip offset)
0 chips	-1024 to -513 chips	-512 to -1 chips	0 to 511 chips
512 chips	-512 to -1 chips	0 to 511 chips	512 to 1023 chips
1024 chips	0 to 511 chips	512 to 1023 chips	1024 to 1535 chips

Table 1.

Illustration of perceived chip offsets at varying distances from a base station.

As illustrated in Table 1, when system time is delayed 1024 chips, receivers having input signal delays of zero chips will perceive remote units between 125 and 186 km as having chip offsets of between 0 and 511. Likewise, receivers having input signal delays of 512 chips, will perceive remote units between 63 and 124 km as having chip offsets between 0 and 511. Finally, receivers having input signal delays of 1024 chips will perceive remote units between 0 and 62 km as having chip offsets between 0 and 511. All receivers will be unable to receive remote units whose transmissions are perceived to be outside the 0 to 511 chip window.

The above-described base station is capable of receiving transmissions from remote units outside the normal 512 chip window. In fact, the above-described base station can receive transmissions from remote units that are delayed up to 1535 chips. Additionally, existing base stations can be inexpensively modified in accordance with the preferred embodiment by the addition of delay circuitry as described above.

FIG. 3 is a flow chart showing operation of the base station of FIG. 1 in accordance with the preferred embodiment of the present invention. The logic flow begins at step 300 where receivers 201-202 determine an antenna and delay window to use to demodulate (e.g., antenna 111 with first delay 203, antenna 112 with second delay 204). In particular, in the preferred embodiment of

the present invention each receiver may choose to demodulate signals from any antenna coupled to base station 101. Additionally, each antenna has multiple signal delays that may be chosen by receivers 201-202, depending upon an amount of range extension desired for base station 101. In the preferred embodiment of the present invention multiplexers within each receiver 201-202 choose an antenna and a particular delay from all possibilities of antenna/delay combinations. For purposes of this example it is assumed that receiver 201 chooses antenna 111, having delay 203 as an input, and receiver 202 chooses antenna 112, having delay 204 as an input.

Continuing, at step 301 receivers 201 and 202 receive a transmission from remote unit 114. At step 303 the received signal is delayed a first amount by circuitry 203, and a second amount by circuitry 204. As discussed above, these delays are integer multiples of N, up to (K-1)N (i.e., 0, N, 2N, . . . , (K-1)N). Additionally, delay circuitry 203 and 204 may exist after demodulating the received signal into its baseband components, or may simply serve to delay the received radio-frequency (RF) signal prior to demodulation.

At step 305 the delayed signals are output from delay circuitry 203 and 204, and enter despreaders 207 and 208 respectively. At step 307 despreaders 207 and 208 utilize standard CDMA despreading techniques to despread the delayed signals. More particularly, during despreading, the delayed input signal is despread with a Pseudo-Random (PN) code. The PN code is a 32,768 bit sequence that repeats exactly 75 times every 2 seconds with a chip rate of 1.2288 MegaChips per second. In standard CDMA systems the PN sequence is synchronized to repeat on every even second of system time. Although in the preferred embodiment of the present invention the spreading code utilized is a PN code, one of ordinary skill in the art will recognize that other spreading codes may be utilized as well. At step 307 the system time utilized by PN generator 213 and 215 is delayed a third time period equal to (K-1)N chips by circuitry 214 and 216, respectively. As a result of delaying system time, the PN sequence utilized to despread the delayed signals will not repeat on the even second of system time, but will begin repeating (K-1)N chips after every even second of system time.

Finally, at step 309 the despread data is demodulated by demodulator 209 and decoded by decoder 211. In the preferred embodiment the present

invention despreading and demodulation operations are standard CDMA demodulating/decoding operations described in detail in IS-95B.

As described above, receivers having input signal delays of jN receive remote units having PN offset ranges of (NK-N-jN) to (NK-jN) when system time is delayed by (K-1)N. Therefore, any remote unit with a range between (NK-N-jN) and (NK-jN) will be received by the receiver delayed by jN, and will not be received by receivers having different input signal delays since the signal will lie outside of the receiver's search window. The result is a base station capable of receiving transmissions from remote units outside the normal operating window. Additionally, the above-described base station can receive transmissions from remote units that are delayed up to KN chips with receivers having input signal delays of jN. Additionally, existing base stations can be inexpensively modified in accordance with the preferred embodiment by the addition of delay circuitry as shown.

Also note that in the preferred embodiment each receiver is a RAKE receiver having multiple despreaders. A multiplexer is provided for each despreader to select an antenna and delay. The output of the despreaders are separately demodulated, combined together, then decoded. Each receiver, therefore, has the ability to demodulate received signals spread across multiple windows.

The descriptions of the invention, the specific details and the drawings mentioned above, are not meant to limit the scope of the present invention. For example, in alternate embodiments of the present invention cell's radius can be expanded or contracted by adjusting the delay times for circuits 203, 204, 215, and 216 accordingly. It is envisioned in such an embodiment that controller 219 utilizes clock 217 (system time) and dynamically adjusts delay circuitry to utilize an appropriate delay. For example, during a first time period (e.g., day time hours) controller may delay system time by 1024 chips in order to extend the base station's range to 186 km, during a second time period (e.g., night time hours) controller may delay system time by 512 chips in order to extend the base station's range to 124 km. It is the belief of the inventors that various modifications can be made to the present invention without varying from the spirit and scope of the invention, and it is intended that such modifications come within the scope of the following claims and their equivalents.

Claims

1. An apparatus for range extension within a communication system, the apparatus comprising:

a first receiver comprising:

a first input signal delay having a received signal as an input and outputting the received signal delayed a first time period; and

a first despreader having the received signal delayed the first time period as an input and outputting a first despread signal, wherein the first despreader utilizes a spreading code that is delayed a second time period with respect to system time.

2. The apparatus of claim 1 further comprising:

a second receiver comprising:

a second input signal delay having the received signal as an input and outputting the received signal delayed a third time period; and

a second despreader having the received signal delayed the third time period as an input and outputting a second despread signal, wherein the second despreader utilizes the spreading code that is delayed the second time period with respect to system time.

3. The apparatus claim 2 wherein the third time period is equal to a number selected from the consisting of 0, N, 2N, . . . , (K-1)N, where N is a maximum search demodulation range of the second receiver and K is the maximum round- ay divided by N, rounded up to a nearest integer.

4. The apparatu 2 wherein the second time period is substantially equal to (K-1)N, whe maximum search and demodulation range of the first receiver and K ximum round-trip delay divided by N, rounded up to a nearest integer.

5. The apparat 2 wherein the received signal input into the first input signal delay ori a first sector of a base st on and the received signal

input into the second input signal delay originates from a second sector of the base station.

6. A method for range extension within a communication system, the method comprising the steps of:

receiving a first signal;

delaying the first signal a first time period to produce a first delayed signal;

despreading the first delayed signal utilizing a spreading code that has been delayed a second time period in order to receive signals transmitted within a first range;

receiving a second signal;

delaying the second signal a third time period to produce a second delayed signal; and

despreading the second delayed signal utilizing the spreading code that has been delayed the second time period in order to receive signals transmitted within a second range.

7. The method of claim 6 wherein the step of delaying the first signal the first time period comprises the step of delaying the first signal the first time period wherein the first time period is equal to a time period selected from the group consisting of 0, N, 2N, . . . , (K-1)N, where N is a maximum search and demodulation range of the second receiver and K is the maximum round-trip delay divided by N, rounded up to a nearest integer.

8. The method of claim 7 wherein the step of delaying the second signal the third time period comprises the step of delaying the second signal the third time period wherein the third time period is equal to a time period selected from the group consisting of 0, N, 2N, . . . , (K-1)N.

9. The method of claim 6 wherein the step of despreading the first delayed signal utilizing the spreading code that has been delayed the second time period comprises the step of despreading the first delayed signal utilizing the spreading code that has been delayed a time period substantially equal to (K-1)N, where N is

a maximum search and demodulation range of the first receiver and K is the maximum round-trip delay divided by N, rounded up to a nearest integer.

10. The method of claim 6 wherein the step of despreading the second delayed signal utilizing the spreading code that has been delayed the second time period comprises the step of despreading the second delayed signal utilizing the spreading code that has been delayed a time period substantially equal to (K-1)N, where N is a maximum search and demodulation range of the first receiver and K is the maximum round-trip delay divided by N, rounded up to a nearest integer.

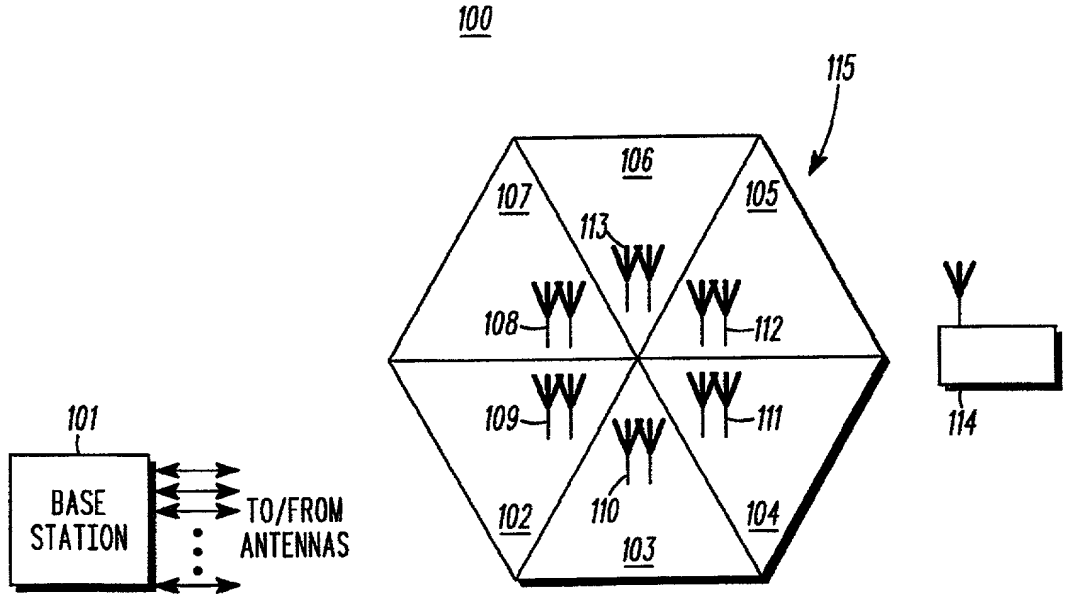
100
115
106
107
105
113
108
112
109
111
110
102
104
103
101
BASE STATION
TO/FROM ANTENNAS
114

FIG. 1

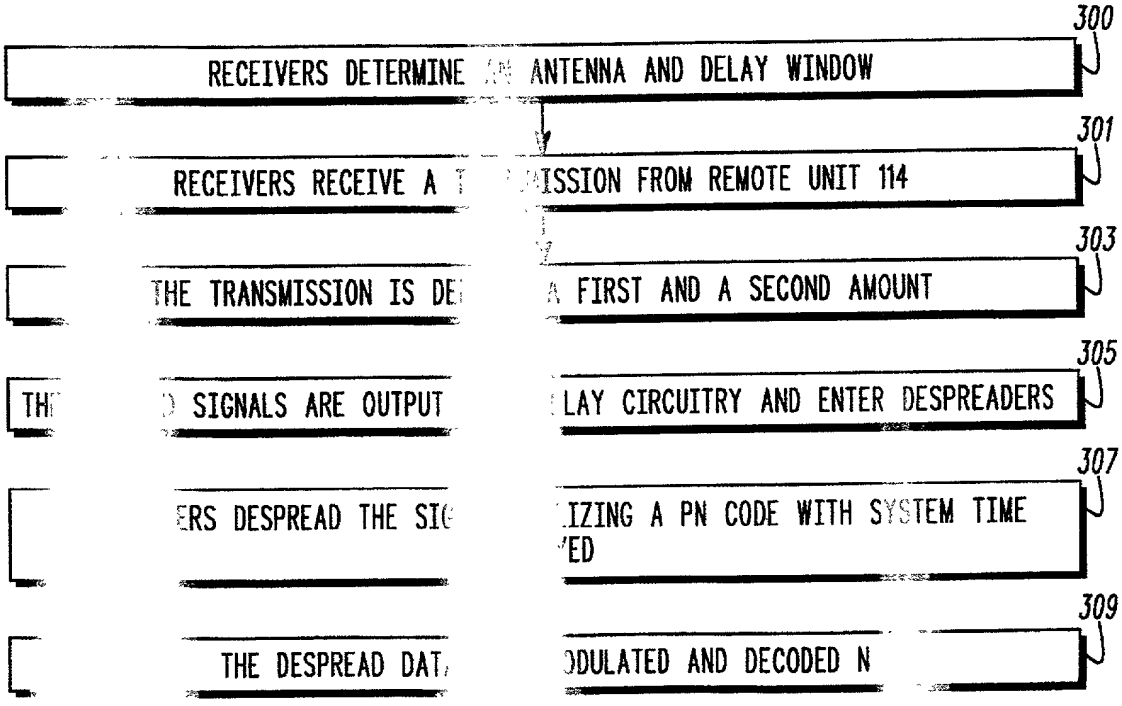
300
RECEIVERS DETERMINE ANTENNA AND DELAY WINDOW
301
RECEIVERS RECEIVE A TRANSMISSION FROM REMOTE UNIT 114
303
THE TRANSMISSION IS DE A FIRST AND A SECOND AMOUNT
305
TH SIGNALS ARE OUTPUT LAY CIRCUITRY AND ENTER DESPREADERS
307
ERS DESPREAD THE SIG IZING A PN CODE WITH SYSTEM TIME ED
309
THE DESPREAD DAT ODULATED AND DECODED N

FIG. 3

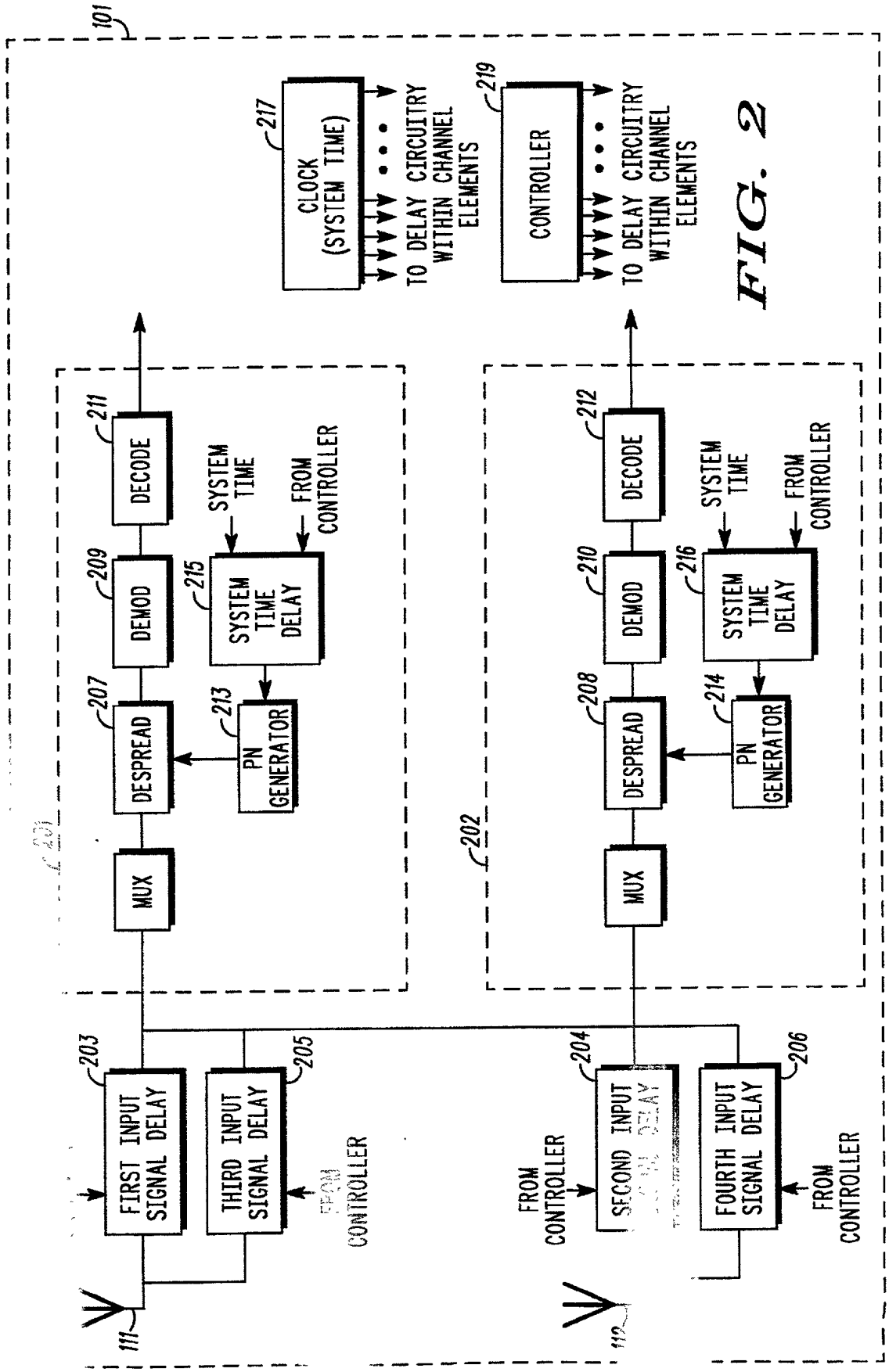
101
217
CLOCK (SYSTEM TIME)
TO DELAY CIRCUITRY WITHIN CHANNEL ELEMENTS
219
CONTROLLER
TO DELAY CIRCUITRY WITHIN CHANNEL ELEMENTS
211
DECODE
209
DEMOD
207
DESPREAD
213
PN GENERATOR
215
SYSTEM TIME DELAY
SYSTEM TIME
FROM CONTROLLER
MUX
202
212
DECODE
210
DEMOD
208
DESPREAD
214
PN GENERATOR
216
SYSTEM TIME DELAY
SYSTEM TIME
FROM CONTROLLER
MUX
203
FIRST INPUT SIGNAL DELAY
205
THIRD INPUT SIGNAL DELAY
FROM CONTROLLER
204
FROM CONTROLLER
SECOND INPUT
206
FOURTH INPUT SIGNAL DELAY
FROM CONTROLLER
111
112

FIG. 2

PATENT
Attorney Docket No. 440490

COMBINED DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION AND POWER OF ATTORNEY

☐ Declaration Submitted with Initial Filing OR
☒ Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16(e)) required)

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name. I believe I am the original, first, and sole inventor *(if only one name is listed below)* or an original, first, and joint inventor *(if plural names are listed below)* of the subject matter which is claimed and for which a patent is sought on the invention entitled:

SEPARATION DEVICES AND PROCESSES

the specification of which:

☐ is attached hereto.
☐ was filed on as Application No. and was amended on *(if applicable)*.
☐ was filed by Express Mail No. *as Application No. not known yet*, and was amended on *(if applicable)*.
☒ was filed on January 31, 2000 as PCT International Application No. PCT/US00/02071.

I state that I have reviewed and understand the contents of the specification identified above, including the claim(s), as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT international filing date of the continuation-in-part application.

I claim foreign priority benefits under 35 USC 119(a)-(d) or (f), or 365(b) of any foreign application(s) for patent, inventor's or plant breeder's rights certificate(s), or 365(a) of any PCT international application(s) designating at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application(s) for patent, utility model, design registration, inventor's or plant breeder's rights certificate(s), or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter and having a filing date before that of the application(s) from which the benefit of priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Claimed YES	Priority Claimed NO	Certified Copy Attached? YES	Certified Copy Attached? NO
			☐	☐	☐	☐
			☐	☐	☐	☐
			☐	☐	☐	☐
			☐	☐	☐	☐

PATENT
Attorney Docket No. 440490

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SEPARATION DEVICES AND PROCESSES

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Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Claimed YES	NO	Certified Copy Attached? YES	NO
			☐	☐	☐	☐
			☐	☐	☐	☐
			☐	☐	☐	☐
			☐	☐	☐	☐

In re Appln. of FENDYA, ET AL.
Attorney Docket No. 440490

As a named inventor, I hereby appoint Leydig, Voit & Mayer, Ltd. to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: Customer Number 23548.

I further direct that correspondence concerning this application be directed to Leydig, Voit & Mayer, Ltd.: Customer Number 23548.

I declare that all statements made herein of my own knowledge are true, that all statements made on information and belief are believed to be true, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of **sole or first inventor:** Thomas J. Fendya

Inventor's signature _____

Date _____ Country of Citizenship: USA

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Full name of **second joint inventor:** Mark F. Hurwitz

Inventor's signature _____

Date _____ Country of Citizenship: USA

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In re Appln. of FENDYA, ET AL.
Attorney Docket No. 440490

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1

Full name of **sole or first inventor:** Thomas J. Fendya

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Date March 11, 2002

Country of Citizenship: USA

Residence: Ithaca, New York NY

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APPLICATION INFORMATION

Application Type::	Regular
Subject Matter::	Utility
Suggested classification::	
Suggested Group Art Unit::	
CD-ROM or CD-R?::	None
Number of CD Disks:	
Number of Copies of CDs::	
Sequence Submission?::	
Computer Readable From (CRF)?::	No
Number of Copies of CRF::	
Title::	SEPARATION DEVICES AND PROCESSES
Attorney Docket Number::	440490
Request for Early Publication?::	No
Request for Non-Publication?::	No
Suggested Drawing Figure::	
Total Drawing Sheets::	11
Small Entity::	No
Licensed US Govt. Agency::	
Contract or Grant Numbers::	
Secrecy Order in Parent Appl.?::	No

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Representative Designation::	Registration Number::	Representative Name::

DOMESTIC PRIORITY INFORMATION

Application::	Continuity Type::	Parent Application::	Parent Filing Date::

FOREIGN APPLICATION INFORMATION

Country::	Application Number::	Filing Date::
US	60/114,972	01/29/99
WO	PCT/US00/02071	01/31/00

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